

Short Pulsed Laser Methods for Velocimetry and Thermometry in High Enthalpy Facilities, Phase I

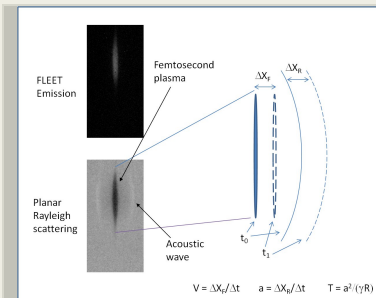
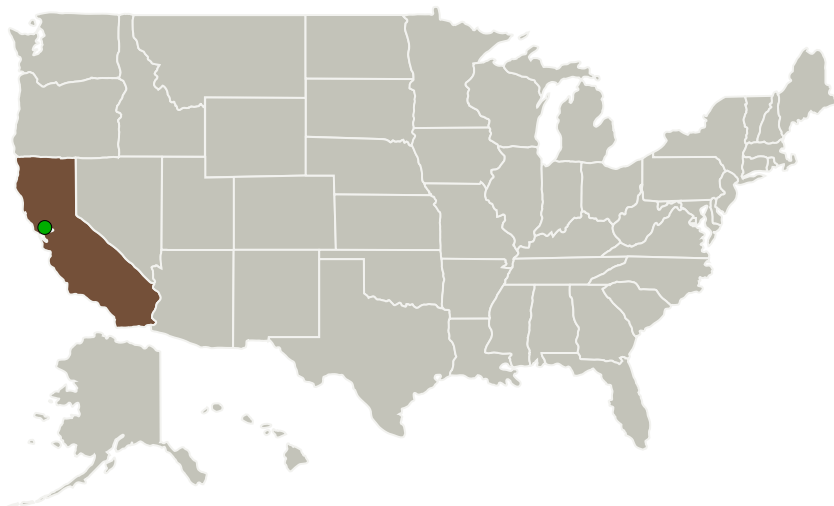
Completed Technology Project (2015 - 2015)



Project Introduction

A suite of laser-based diagnostics is proposed to measure velocity and temperature simultaneously using unseeded techniques in high enthalpy flows relevant to reentry flight. The two main types of regions that are found in a typical hypersonic flow field around a vehicle are addressed by developing separate diagnostics for each. In regions far from the body where the flow is mostly non-dissociated, femtosecond laser electronic excitation tagging (FLEET) is proposed for velocity combined with planar Rayleigh scattering to measure temperature via the imaging of an acoustic wave triggered by the FLEET pulse. In the highly dissociated region near the stagnation point of the reentry body, either backward air lasing or radar REMPI will be applied to spectrally resolve a transition of atomic oxygen. The latter two techniques use the same two-photon excitation scheme, but backward air lasing relies on a population inversion induced in the measurement volume, and radar REMPI relies on the microwave interrogation of an induced plasma. The goal of the Phase I study will be to determine which of these two techniques provides the best signal-to-noise ratios in the dissociated regions, and to establish the performance of the combined FLEET/Rayleigh scattering method in the non-dissociated regions.

Primary U.S. Work Locations and Key Partners



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Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Organizational Responsibility	2
Project Management	2
Images	3
Technology Maturity (TRL)	3
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
MetroLaser, Inc.	Lead Organization	Industry Minority-Owned Business, Small Disadvantaged Business (SDB)	Laguna Hills, California
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations

California

Project Transitions

**June 2015:** Project Start**December 2015:** Closed out

Closeout Summary: Short Pulsed Laser Methods for Velocimetry and Thermometry in High Enthalpy Facilities, Phase I Project Image

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/139326>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

MetroLaser, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jacob George

Co-Investigator:

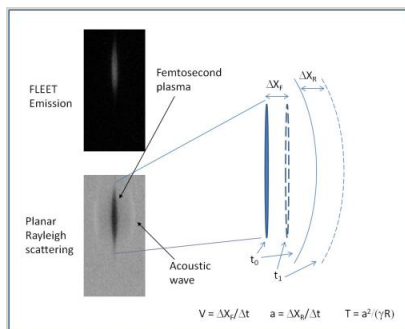
Jacob George

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Images

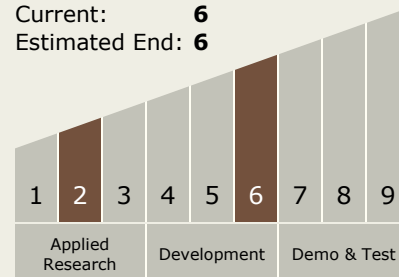


Briefing Chart Image

Short Pulsed Laser Methods for Velocimetry and Thermometry in High Enthalpy Facilities, Phase I
(<https://techport.nasa.gov/image/134198>)

Technology Maturity (TRL)

Start: **2**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX09 Entry, Descent, and Landing
 - └ TX09.4 Vehicle Systems
 - └ TX09.4.5 Modeling and Simulation for EDL

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System